INDICATORS OF SUSTAINABLE DEVELOPMET IN MINING

Author: Drd. Alina Adela Davidoiu
1University of Petrosani, 20 University Street no. 20, 332 006, Petrosani, Romania
alina.davidoiu @ yahoo.com, Tel.0765646291

ABSTRACT: *The concept of sustainable development in mining is in its infancy. However the mining industry to adopt sustainable development strategies that will establish goals and develop ways and means of achieving them. Sustainable development indicators varies with spatial and temporal changes in environmental conditions, socio-economic and political.*
Different institutions phenomenon concern not enough has been done to standardize the assessment, measuring progress sustainable development at global, regional and national levels. Course would require a large collaborative approach and holistic. Sustainable development indicators can be associated levels: policy, planning and implementation

KEY WORDS: sustainable development, mining areas, sustainable development indicators

Indicators perform many functions. They can lead to better decisions and more effective actions by simplifying, clarifying and making aggregated information available to policy makers. They can help incorporate physical and social science knowledge into decision-making, and they can help measure and calibrate progress toward sustainable development goals. They can provide an early warning to prevent economic, social and environmental setbacks. They are also useful tools to communicate ideas, thoughts and values.

Sustainable development has been defined in many ways, but the most frequently quoted definition is from*Our Common Future*, also known as the Brundtland Report:

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts:

- *the concept of* ***needs****, in particular the essential needs of the world's poor, to which overriding priority should be given; and*
- *the idea of* ***limitations*** *imposed by the state of technology and social organization on the environment's ability to meet present and future needs."*

Indicators have been defined in a number of different ways: the Dictionary of Environment and Sustainable Development (Gilpin, 1996) defines an indicator as: a substance or organism used as a measure of air or water quality, or biological or ecological well-being.

The ISO 14000 (ISO, 1999) series defines an environmental indicator as: a specific expression that provides information about an organisation's environmental performance, efforts to influence that performance, or the condition of the environment.

The OECD (The Organisation for Economic Co-operation and Development 1993) provides another useful definition of an indicator as: a parameter or a value derived from parameters, which provides information about a phenomenon. The indicator has significance that extends beyond the properties directly associated with the parameter values. Indicators possess a synthetic meaning and are developed for a specific purpose.

Despite the apparent vagueness of the term, indicators have been widely used for monitoring and assessment of numerous environmental impacts of operations, and are increasingly used in social and economic arenas. To date the emphasis of the vast majority of indicators has been placed on reporting, rather than management of impacts on mining on sustainable development. Consequently, to date, the most important criteria that define useful indicators are the capacity to simplify, quantify, analyse and communicate otherwise complex and complicated information, and the ability to make particular aspects of a complex situation stand out and thus reduce the level of uncertainty in the formulation of strategies, decisions or actions.

An ever-increasing number of environmental, social and economic indicators are available.

List of indicators

Demographic changes

- Natural increase rate
- Total fertility rate
- Life expectancy of persons aged 65
- International migrations indicator

Public health

- Life expectancy of infant in health

- Infant deaths
- Disability free life expectancy at the age of 65
- Standardised death rates caused by circulatory system diseases and malignant neoplasms
- Euro Health Consumer Index EHCI

Social integration
- At-risk-of-constant-poverty
- At-risk-of-poverty or social exclusion
- Inequality of income distribution
- Debt of households

Education
- Life-long learning of adults
- Children aged 3-5 undergoing pre-primary education in rural areas
- Public expenditure on education

Access to labour market
- People living in jobless households
- Long-term unemployment rate
- Unemployment rate
- Employment rate of disabled persons
- Gender pay gap

Public safety
- Rates of detectability of delinquents in crimes
- Road traffic accidents fatalities per 1 million population

Sustainable consumption patterns
- Number of vehicles per 1000 population
- Electricity consumption in households per capita
- Consumption of vegetables per capita in households

Generally, these indicators are either used in isolation to analyse the performance of sites, companies and sectors as they relate to one of the three dimensions, or, increasingly, in combination as a means of measuring progress towards and away from sustainability.

However, the simple combination of sets of environmental, economic and social performance indicators does not necessarily represent the creation of indicators that are capable of truly describing the extent to which a mining project is contributing or detracting from sustainable development goals over time from an inter-generational equity perspective.

In turn, while indicators allow the complexity of events and trends to be reduced, and more easily understood and managed, there is a danger that the proliferation of indicators and different approaches to their development and use could ultimately undermine their effectiveness.

As noted above, indicators are often partitioned into the three dimensions – environmental, social and economic – or integrated in some way to give a means of measuring progress towards or away from sustainability. However, in many instances, the indicators that are used to assess performance in the individual dimensions are identical to those used to measure sustainability, although in the latter case indicators from different dimensions are often considered in combination to show the positive or negative impact of performance in one dimension on performance in the remaining dimensions. Recent MERN research (2001) has demonstrated that improving environmental performance may sometimes negatively impact social or economic performance, or vice versa – showing that progression across the three dimensions may not occur at the same rate, or even in the same direction at the same time. Where "aggregation" of indicators from different dimensions is necessary, data normalisation, (subjective) weighting factors, or other statistical manipulation may need to be applied. The concept of sustainability or sustainable development is a complex one, with many definitions of what is and what not sustainable (see, for example, Common, 1995, Beckerman, 1996 for examples of widely differing views on sustainability). Much of the debate is about ways in which the concept can be operationalised. For clarity, the following sections focus on the development of indicators in the individual dimensions, although the integration of indicators is also considered where appropriate.

Finally, of equal importance to the indicators that have been developed, are those that have not: there are few indicators or indicator systems that are capable of demonstrating changes in performance with respect to two key areas of sustainable development:

• Product use and the extent to which a product is contributing to quality of life, health and well being over time – for the mining sector the benefits of products derived from its many activities is typically overlooked in the overall assessment of the sector's contribution to sustainable development.

• Business practice and the extent to which a project is being managed according to practices that will contribute to sustainable development goals. Subsequent sections argue that business practice indicators would be one of the most effective systems for financial investors to use to assist in the evaluation of whether an operation is likely to represent a sound, sustainable investment.

CONCLUSIONS:

Applying the concept of sustainable development in mining, especially in mining areas where activities are generally mono is difficult because deposits are non-renewable resources and therefore, sooner or later, they will be exhausted.

Therefore, these areas should be a profitable mining, allowing further development, or parallel to other activities.

There is a solution to preserve today's natural resources to create wealth for future generations.

Natural durability mining projects will be synonymous with the overall growth and support the mining business. International acceptance of such a development is urgently needed. Applying the principles of sustainable development in mining will depend more on business practices and standards.

Sustainability is an evolving process. Global mining industry, from the beginning to adopt general ecological principles pollution control. It needs to get on preventing and combating pollution, pollution control not only who will soon be a thing of the past in other industries.

The issue of sustainability is becoming increasingly important for the minerals extraction industry. To

respond to the challenge, the industry must be able to measure its progress towards more sustainable development. The generic framework for environmental indicators of sustainable development proposed in this work could be used as a tool for assessing the level of environmental sustainability of industry and for identifying more sustainable options for the future. Most of the indicators included in the framework apply across the industry; more specific indicators for different sub-sectors can be developed separately. The latter have to be considered on a case-by-case basis to reflect specific characteristics of different operations.

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Table 1: Summary of indicator types

Summary of indicator types		Application		
Indicator Type	**Overview**	**Environment a**	**Social**	**Economic**
Indicator Type	Descriptive indicators can relate to drivers, pressure, state, impact, or response (as set out in the DPSIR Framework - see Table 2) across the three dimensions of sustainable development. Quantitative and qualitative descriptive indicators describe the factual situation, but do not assess whether this is good or bad - they are in practical terms a statement of fact	✓		✓
Performance	Performance indicators compare the actual situation with targets, allowing progress towards such targets to be measured. Relevant targets include those set at national and international levels, and voluntary targets that relate to more explicitly to sustainable development	✓		✓
Efficiency	Efficiency indicators provide insights into the efficiency of processes and product use. They are, therefore, largely limited to environmental applications at present	✓	x	x
Sustainable Reference Values	These relate to target levels of environmental quality set from the specific perspective of sustainable development. At present, only environmental SRVs are available, and these relate to acid deposition, and air quality (used by the European Environment Agency)	✓	x	x
Production	Production-related indicators are drawn from standard engineering approaches to process management and relate to both environmental and economic aspects of the production process. These indicators are limited in the scope of their application, representing as they do a narrow focus, largely internal to the company (the typical end-user)	✓	x	✓
Regulatory	Regulatory indicators are drawn from consideration of legal compliance and typically are limited to the environmental dimension (e.g. release of pollutants to air, land and water). The use of regulatory indicators fails to capture the significance of moving 'beyond compliance' and are static relative to the kinetic sustainable development process	✓	x	x
Accounting	Accounting indicators may be used for internal or external reporting with a focus on liability management, and efficient and transparent tracking of costs associated with waste production, management and disposal	✓	x	✓
Economic	Economic indicators can be used to value external environmental and social costs and allow their internalisation. These are potentially powerful tools and are an essential input to any lifecycle-based assessment of environmental performance	✓		✓
Quality	Similar to production-related indicators, quality-based indicators have as their focal point waste minimisation during the production process (assessed from dual aspects of costs savings and minimisation of pollutant release)	✓	x	✓
Ecological	Ecological indicators relate to the local, regional, national and international impacts on ecosystem health resulting from all aspects of human activity	✓	x	x